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World Intellectual Property Organization (WIPO) - Geneva, Switzerland
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1325748

THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

May 24, 2005

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APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A
FILING DATE.

APPLICATION NUMBER: 60/566,148

FILING DATE: *April 27, 2004*

RELATED PCT APPLICATION NUMBER: PCT/US05/14514



Certified by

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

042704
17231 U.S. PTO

PTO/SB/16 (01-04)

Approved for use through 07/31/2006. OMB 0651-0032
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EL919129043US

22151 U.S. PTO
60/566148

042704

INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Rafael	Garcia	Tempe, Arizona
Additional inventors are being named on the <u>1</u> separately numbered sheets attached hereto		
TITLE OF THE INVENTION (500 characters max)		
METHOD TO SYNTHESIZE LUMINESCENT SILICON-DOPED GALLIUM NITRIDE POWDERS		
Direct all correspondence to: CORRESPONDENCE ADDRESS		
<input checked="" type="checkbox"/> Customer Number:	28,529	
OR		
<input type="checkbox"/> Firm or Individual Name		
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Address		
City	State	Zip
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ENCLOSED APPLICATION PARTS (check all that apply)		
<input checked="" type="checkbox"/> Specification Number of Pages <u>2</u>	<input type="checkbox"/>	CD(s), Number _____
<input type="checkbox"/> Drawing(s) Number of Sheets _____	<input checked="" type="checkbox"/>	Other (specify) <u>postcard</u>
<input type="checkbox"/> Application Data Sheet. See 37 CFR 1.76		
METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT		
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27.	FILING FEE Amount (\$)	
<input checked="" type="checkbox"/> A check or money order is enclosed to cover the filing fees.		
<input checked="" type="checkbox"/> The Director is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: <u>070135</u>	\$80.00	
<input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.		
The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.		
<input checked="" type="checkbox"/> No.		
<input type="checkbox"/> Yes, the name of the U.S. Government agency and the Government contract number are: _____		

[Page 1 of 2]

Respectfully submitted,

SIGNATURE 

TYPED or PRINTED NAME Thomas D. MacBlain

TELEPHONE 602-530-8088

Date 4/27/2004

REGISTRATION NO. 24,583

(if appropriate)

Docket Number: 9138-0156

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop Provisional Application, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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PROVISIONAL APPLICATION COVER SHEET
Additional Page

PTO/SB/16 (08-03)

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Docket Number 9138-0156

INVENTOR(S)/APPLICANT(S)		
Given Name (first and middle [if any])	Family or Surname	Residence (City and either State or Foreign Country)
Fernando A.	Ponce	Tempe, Arizona
Abigail	Bell	Tempe, Arizona

[Page 2 of 2]

Number 1 of 1

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FEE TRANSMITTAL

for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

 Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$ 80)

Complete if Known

Application Number	11
Filing Date	herewith
First Named Inventor	Garcia
Examiner Name	
Art Unit	
Attorney Docket No.	9138-0156

METHOD OF PAYMENT (check all that apply)

 Check Credit card Money Order Other None
 Deposit Account:

Deposit Account Number: 070135
Deposit Account Name: Gallagher & Kennedy, P.A.

The Director is authorized to: (check all that apply)

Charge fee(s) indicated below Credit any overpayments
 Charge any additional fee(s) or any underpayment of fee(s)
 Charge fee(s) indicated below, except for the filing fee to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity	Small Entity	Fee Code (\$)	Fee Code (\$)	Fee Description	Fee Paid
1001 770	2001 385	Utility filing fee			
1002 340	2002 170	Design filing fee			
1003 530	2003 265	Plant filing fee			
1004 770	2004 385	Reissue filing fee			
1005 160	2005 80	Provisional filing fee	80		
SUBTOTAL (1) (\$)		80			

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

Total Claims	Independent Claims	Multiple Dependent	Extra Claims	Fee from below	Fee Paid
			-20** =	X	=
			- 3** =	X	=

Large Entity	Small Entity	Fee Description
1202 18	2202 9	Claims in excess of 20
1201 86	2201 43	Independent claims in excess of 3
1203 290	2203 145	Multiple dependent claim, if not paid
1204 86	2204 43	** Reissue independent claims over original patent
1205 18	2205 9	** Reissue claims in excess of 20 and over original patent
SUBTOTAL (2) (\$)		

**or number previously paid, if greater; For Reissues, see above

3. ADDITIONAL FEES

Large Entity Small Entity

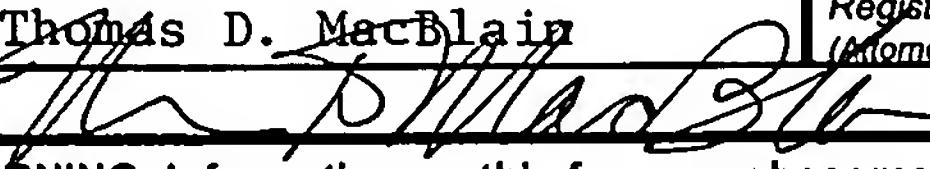
Fee Code (\$)	Fee (\$)	Fee Code (\$)	Fee (\$)	Fee Description	Fee Paid
1051 130	2051 65	Surcharge - late filing fee or oath			
1052 50	2052 25	Surcharge - late provisional filing fee or cover sheet			
1053 130	1053 130	Non-English specification			
1812 2,520	1812 2,520	For filing a request for ex parte reexamination			
1804 920*	1804 920*	Requesting publication of SIR prior to Examiner action			
1805 1,840*	1805 1,840*	Requesting publication of SIR after Examiner action			
1251 110	2251 55	Extension for reply within first month			
1252 420	2252 210	Extension for reply within second month			
1253 950	2253 475	Extension for reply within third month			
1254 1,480	2254 740	Extension for reply within fourth month			
1255 2,010	2255 1,005	Extension for reply within fifth month			
1401 330	2401 165	Notice of Appeal			
1402 330	2402 165	Filing a brief in support of an appeal			
1403 290	2403 145	Request for oral hearing			
1451 1,510	1451 1,510	Petition to institute a public use proceeding			
1452 110	2452 55	Petition to revive - unavoidable			
1453 1,330	2453 665	Petition to revive - unintentional			
1501 1,330	2501 665	Utility issue fee (or reissue)			
1502 480	2502 240	Design issue fee			
1503 640	2503 320	Plant issue fee			
1460 130	1460 130	Petitions to the Commissioner			
1807 50	1807 50	Processing fee under 37 CFR 1.17(q)			
1806 180	1806 180	Submission of Information Disclosure Stmt			
8021 40	8021 40	Recording each patent assignment per property (times number of properties)			
1809 770	2809 385	Filing a submission after final rejection (37 CFR 1.129(a))			
1810 770	2810 385	For each additional invention to be examined (37 CFR 1.129(b))			
1801 770	2801 385	Request for Continued Examination (RCE)			
1802 900	1802 900	Request for expedited examination of a design application			

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) (\$)

(Complete if applicable)

Name (Print/Type)	Thomas D. MacBlain	Registration No. (Attorney/Agent)	24,583	Telephone	602-530-8088
Signature	Signature: 				
Date	4/27/2004				

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Garcia et al.

Filed: Herewith

Title: **METHOD TO SYNTHESIZE LUMINESCENT SILICON-DOPED GALLIUM NITRIDE POWDERS**

CERTIFICATE OF MAILING BY EXPRESS MAIL
"Express Mail" mailing label number EL919129043US

Mail Stop Provisional Patent Application
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

I hereby certify that the following correspondence is being deposited in the United States Postal Service as Express Mail on the date shown below in an envelope addressed as shown above.

1. Provisional Application for Patent Cover Sheet (2 pages);
2. Fee Transmittal for FY 2004 (1 page in duplicate);
3. Specification (2 pages plus cover sheet);
4. Check for \$80.00; and
5. A return receipt postcard.

4/27/04
Date

Suzanne Shields
Suzanne Shields

GALLAGHER & KENNEDY, P.A.
2575 East Camelback Road
Phoenix, Arizona 85016-9255
Tel. No. (602) 530-8000
Fax. No. (602) 530-8500

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Provisional Patent Application

**Title: METHOD TO SYNTHESIZE LUMINESCENT SILICON-DOPED
GALLIUM NITRIDE POWDERS**

Inventor(s): Rafael Garcia, Tempe, Arizona
Fernando A. Ponce, Tempe, Arizona
Abigail Bell, Tempe, Arizona

Attorneys for Applicant: Thomas D. MacBlain
Donna H. Catalfio
Gallagher & Kennedy, P.A.
2575 East Camelback Road
Phoenix, AZ 85016-9225

METHOD TO SYNTHESIZE LUMINESCENT SILICON-DOPED GALLIUM NITRIDE POWDERS

The problem which this invention solves is:

1. Low quality in n-type gallium nitride powders; and
- 5 2. Doping and co-doping GaN-powders for electroluminescent devices.

We have developed a new method to produce silicon-doped gallium nitride powders.

This method has a high control over the concentration of silicon in the final product. The method consists in reacting a gallium-silicon alloy with ultra-high purity ammonia in a horizontal quartz tube reactor at 1200°C curing 1.5 hours.

10 The gallium-silicon alloy is prepared using a mechanical mixer. Ultra-high purity gallium melt and silicon powder are placed in a stainless steel sealed vessel under vacuum at a selected temperature (e.g. 500°C) and the vessel is mechanically mixed for several hours in order to produce a highly homogeneous alloy. A variant to this invention is to place the gallium melt in contact with a silicon crystal (like the melt on top of a silicon wafer, or dipping a silicon 15 crystal on the melt) and increasing the temperature to a value that results in the desired solubility of silicon (according to the Ga-Si phase diagram). The gallium-silicon alloy is then removed and reacted as previously described. An ultrasonic agitator may be used to accelerate the solubility process.

We have been working on the synthesis of gallium nitride and related compounds as part 20 of a GaN microcrystalline powder project supported by a gift from Durel Corporation (now a division of Rogers Corporation). Professor Fernando A. Ponce and I (Rafael Garcia) planned my second year of postdoctoral stay at Arizona State University (ASU), this second year with the emphasis on learning how to dope such GaN powders. This work is of high scientific as well as technological importance. Durel's gift allowed us to explore directions which were not 25 mainstream to current technology. The importance of these powders is in their potential as electroluminescent phosphors. The first stage involved production of GaN powders with high crystalline quality and high light emission efficiency. The second stage involved learning to dope such powders. We started with a new series of experiments using silicon as a donor agent and we found that it is possible to produce silicon doped gallium nitride powder using a gallium- 30 silicon alloy as a precursor. We also found that through this method it is possible to control the

concentration of silicon in the gallium nitride powders. The material produced resulted in surprisingly high silicon-related luminescence.

This invention can be used as a method to produce n-type doped phosphors that could be used as active material in electroluminescent devices.